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SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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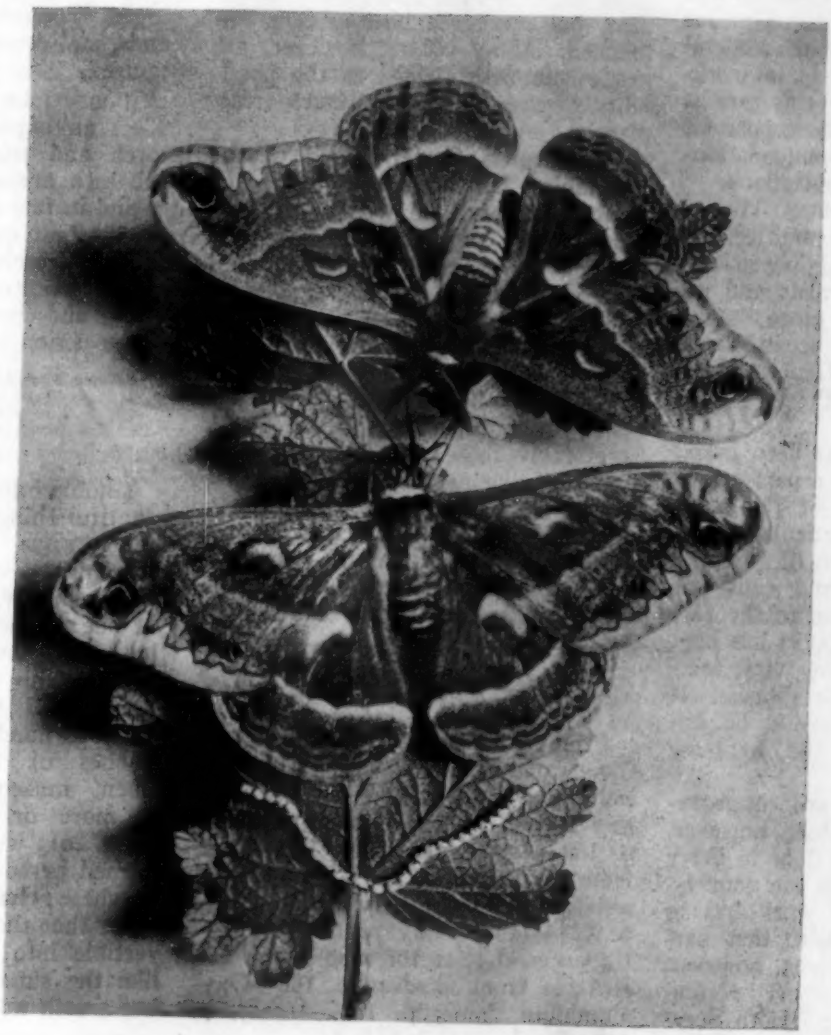

BEAUTIFUL THOUGH COMMON

Coming of Cool Weather Brings Cecropias

(See page 154)

Vol. XVI No. 440

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Senate Committee Investigates Cancer

Medicine

By Flora G. Orr

Cancer, rapidly becoming the most menacing danger to life of all persons over 45 years of age, is to receive the spotlight of congressional attention this fall.

The result, confidently expected, is that a continuous program of financial support for research work on the nature and cause of this disease will be drawn up in the form of an authorization bill. That such a bill would pass both houses of Congress with little debate is scarcely questioned.

The Senate Commerce Committee is undertaking, at the request of the Senate, an investigation into all means and methods whereby the Federal Government can be of help in working towards a solution of this serious health problem. It is to report its findings and make recommendations for legislation and appropriations.

As a first step, Senator Wesley Jones, chairman of the committee, has written to several leading physicians, surgeons, physicists, chemists and radiologists who attended, more than a year ago, a cancer conference in Washington called by Surgeon General Hugh Cumming of the U. S. Public Health Service.

Each of these men has been asked whether he agrees with a report drawn up by a sub-committee of that conference. This report particularly recommends a long program of research work into the nature and cause of cancer, and calls attention to the fact that lack of financial support has kept the world back in learning vital facts about the nature of this disease. It also states that there should be improvement in surgery and light-ray treatment technique.

Excellent work toward improvement in treating the disease, however, the report says, is being done in every well-equipped hospital in the country. Not all experts whose work has to do with cancer agree with that particular portion of the report, however.

Undoubtedly, the report recommends, the U. S. Public Health Service should be enabled to develop a group of scientific workers who would give their lives to cancer research. The especial lines of work which seem to be indicated at the present time, would be research work on the general biochemistry of the cell and considerable work in the standardization of X-ray and radium radiation.

Relative to the nature of the cancer cell, many scientists who now feel that they are groping in the dark, believe that if normal cells and cancer cells could be grown side by side, long experimentation might show some form of chemical or physical treatment which would destroy the cancer cells, but leave the healthy cells untouched. Many others, however, are pessimistic with regard to the possibility of ever finding any such treatment.

Dr. Francis Carter Wood of the Columbia University Institute of Cancer Research, in writing to Senator Jones, pointed out how the existing Government bureau can contribute to the program of cancer research.

"If Congress should decide to support this research work, I think the work should be done in already established institutes," wrote Dr. Wood, "preferably those already existing as a part of the machinery of the government."

The Bureau of Standards laboratories could undertake the work of discovering practical methods for the use of radium and X-ray, he says; the Bureau of the Census for obtaining and tabulating statistical reports; and the Public Health Service for other laboratory studies.

The work of standardizing X-ray and radium is now proceeding at the Bureau of Standards, but in order to finish it up quickly, the Bureau undoubtedly needs more help and more money and more apparatus.

"The Public Health Service aspect of the question is in some ways the most vital," Dr. Wood continued. "It would be advisable to have a corps of experts there to work on the problem. A far-seeing program should be arranged, in order to avoid wasting funds, and continuous support will be required.

"It may take two or three years to collect an expert staff in cancer research and train them. Very few such men are available in this country and in fact anywhere in the world, and the best quality of men will not devote themselves to such work unless there is strong evidence that their salaries and opportunities will continue over a period of years.

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Cecropia

Entomology

A noble exception to the rule that beautiful things are rare is found in the cecropia moth, illustrated on our front cover. It is one of the most common of the larger moths, yet one of the most beautiful. Now that cooler weather has come, many persons who do not ordinarily seek insects will find cecropias coming ready to hand, stupefied by the first touches of frost. By the same token, museum entomologists will be more or less pestered by the offers of well-meaning but uninformed persons who have made one of these chance captures and imagine that they have something convertible into cash. The cecropia is like the sunset, pricelessly beautiful but worth nothing in terms of cash.

Science News-Letter, September 14, 1929

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No Human Progress Without Crime

Psychology

By Emily C. Davis

"America must try to repress crime, and yet if America succeeds wholly in repressing crime the country will be lost."

It was a psychologist speaking, Dr. Knight Dunlap, head of the department of psychology at the Johns Hopkins University.

The American public has been hearing doctors of mental disease explain the crime situation in terms of unfortunate personalities that run amuck in uncontrollable emotion, and in terms of personalities so skewed and distorted in their perspective on life that a career of wanton lawlessness is set going. We have heard what judges and welfare workers and statisticians have to say about "the American crime wave."

But what does a psychologist think of America's crime problem when he looks over the broad panorama of motives and trends that sweep races and tribes along for better or worse? The question was put up to Dr. Dunlap because he is not only the author of a textbook on the psychology of social problems, but he is a psychologist who has the reputation of making people sit up and think.

"What do I think about the crime situation and the chances for the future?" he repeated. "Of one thing we may be sure; without crime there is no human progress. We may take warning from those groups of human beings who have become practically successful in eliminating crime from their midst. Communities which attain this goal are not looked upon as models for a great civilization. Their success carries a deadly penalty."

Are you wracking your brain at this point, as the reporter did, to think of any place on this imperfect earth where crime is unknown? Can you see how crime figures as an important ingredient in the formula for a nation's progress? Here are the steps of Dr. Dunlap's reasoning:

Progressive society, he explained, lives in a paradoxical situation. It must have its rules, whether they be laws, bulls, or conventions. These rules must be obeyed, because no group of individuals can live otherwise. In a family or in a city the rules are like a set of balances which weigh rights and privileges so that some degree of gratification is possible for every one. Without this delicate balancing of justice there would be such strife among individuals each seeking to make conditions entirely satisfactory for himself, that no gratification for anybody could result. A city without laws is scarcely to be imagined.

THE BOSTON TEA PARTY is applauded in our schools today, even though it was definitely criminal

Having briefly shown that laws are necessary, the psychologist turned to the less obvious side of the paradox:

"The spirit of law-breaking must be kept alive or society stagnates, and in most cases even slips backward. For if the laws are successful in holding a group of individuals to a rigid course, their civilization becomes crystallized in a fast mould."

History of other races furnishes impressive evidence of what happens when laws are completely dominant, he declared:

"We have many lessons from primitive tribes. Groups in Africa and other inaccessible regions have gone on living in an arrested state of development for centuries. Some of these tribes have walked in the steps of their fathers for a longer period than it has taken our whole complex civilization to be built up.

"A cheap and easy explanation of their lack of progress has been that such human beings rated very low in intelligence and were therefore incapable of inventing labor-saving devices or of acquiring better knowledge of treating the sick or of devising ways of improving their political systems. Some of the tribes were perhaps so. But it is the sheerest nonsense to assume that the African blacks who discovered the smelting and working of iron and who made iron articles of magnificent workmanship with the crudest sort of forges and bellows would have been inherently incapable of further mechanical development. We are more cautious now about jumping to conclusions as to intelligence. The influence of a tribe's political, religious, and economic organizations in promoting and permitting progress in the arts and sciences is now recognized as profound.

"The significant thing about the savages, before the white man or other alien races came among them to cause their disintegration, is the high percentage of law obedience they obtained. Among some tribes, explorers have been unable to find any definite punishments assigned to the breaking of the complex systems of taboos, or forbidden acts. When a tribesman was asked what would happen to an individual who transgressed, the answer has been, 'We do not know. No one ever transgresses.'

"In other cases there were no penalties exacted by a primitive group, but the belief that dire magical results would follow a broken taboo was so strong that obedience was practically certain. In still other cases, the laws or customs were known to be oc- (*Turn to next page*)

No Human Progress Without Crime—*Continued*

casionally broken, but the punishment by the group was so sure and terrible that the mass of the population was awed into submission. So, these savages in no case were free men. They had little personal liberty, but lived in a maze of laws so complicated as to be appalling. And their obedience to the laws was almost ninety-nine and forty-four hundredths per cent. perfect. When such a tribe came into contact with a more lawless one, their culture proved to be like rubber that has lost its resiliency. If forced to take a new shape it breaks down."

Over against this picture of the law-abiding, unchanging primitive tribe may be set the very different picture of the American Revolution with its illegal Boston Tea Party and its Peggy Stewart episode. These are obvious and striking examples of the moral benefits of American law-breaking. But Dr. Dunlap points out that these were no great, isolated outbreaks of popular law defiance, and that less spectacular instances may be found on every hand as evidence that social conditions have progressed.

"Prohibition was put over through years of agitation and work, much of which, from the bar-smashing activities of Carrie Nation to the virtual confiscation of distilleries and breweries, was in direct violation of law," the psychologist said. "Prohibition will doubtless be overthrown within five years through the persistent violation of the Volstead Act. It can be overthrown and replaced by more acceptable and enforceable legislation in no other way.

"Humanization of the marriage and divorce laws in the states occurs in so far as decent and substantial citizens persistently violate their uncivilized features. For it must be understood that securing a divorce by collusion, or by fictitious grounds, or in another state than that in which one is actually a citizen is just as much breaking the law as is bigamy, although not as punishable. Many other subterfuges and expedients resorted to by those whom the law would prevent from marrying, or prevent from separating, or compel to marry, are just as plainly refusals to obey the law. Honest citizens need have no compunctions about these matters when their consciences are clear; but they are wise to avoid getting caught."

The traffic situation provides plenty of everyday examples of how disregard for unsound regulations has brought about progress, and has eliminated unenforceable laws. Chicago tried to make pedestrians cross the street like motor cars with traffic signals. But a short time ago Chicago gave up the attempt and changed its traffic regulations on that point, solely because pedestrians almost universally broke the rule. Had the average walker tamely and patiently obeyed the regulation it would have stood on the books. As it was, officials concluded that even eighteen traffic policemen and a set of lights at a crossing could not properly enforce that unpopular ruling. The pedestrian who stands on the corner, exposed to wind, rain, sunstroke, or frostbitten fingers, feels that his case is different from that of the protected motorist. He will probably always insist on his right to risk his neck by skipping through when he considers the chances of success equal.

Speed limits to motoring are another point on which the public has played a dominant role in shaping traffic rules. There is a steady tendency to increase speed laws, Dr. Dunlap pointed out, because so many people who succeed in driving without causing accidents—that is the so-called safe drivers—persist in going faster than the fifteen or twenty or twenty-five mile limit set by the local officials.

This does not mean that a community should not enforce its laws. he added. It does mean that when the laws are persistently broken, a community should take a careful look at the law and a survey of the situation and see whether the law needs more stringent enforcement or whether it needs to be altered or replaced.

"Women are, in general, less given to servile respect for law as such, than are men," the psychologist continued. "Women may, in certain generations, follow the conventions rather mechanically because they have no definite inclinations in other directions. But when women want to obtain or accomplish certain things the law or the conventions forbid, they do not let regard for the law stand in the way. Conventions they can soon overturn, when a considerable minority agree to do so. Laws crash harmlessly about their heads, with but few casualties, and soon the laws are dead letters: witness the frantic efforts of dull-witted makers of city ordinances and state laws who have unsuccessfully tried to keep women's clothes at the ankle, just above the ankle, well below the knee, just below the knee in succession, and the vain attempts to keep the bathing suits voluminous. If women ever decide to go naked, the law may as well accept it early as late. Women have already crashed the long-standing and one hundred per cent enforced taboo against smoking in dining cars, and men are profiting thereby.

"In the present generation, social progress depends almost entirely upon the women; and the prospects are that a number of antique apple-carts will be upset within the next fifteen years. There is an old-time and supposedly humorous anecdote about a woman whose husband cautions her, 'Don't do that, it's against the law;' to which she replies, 'Well, what of it; it's a silly law.' This may be humorous, but it is no joke. In general, when women are cautiously law-abiding it is for one of three reasons: they may have strong moral convictions which back up the particular law; or they may have estimated the probability of punishment, and decided that infracting the law doesn't pay; or they may believe that the law gives them what they want anyhow. The first two reasons are not important to many women.

"Independence against authority and breaking of rules when the rules are bad are indispensable features of the proper development of a child. Children who are really trained to do what Mamma or Poppa order them to do, whether or no, are inevitably ruined. The child who breaks rules he thinks unwise or unjust at least has a chance to became a useful human being. The apparent paradox is avoided by parents who treat their children like rational beings, standing ready to help the child retrieve his mistakes instead of scolding or punishing. I may say that this is not merely my opinion; it is the opinion of a great many skillful students of child development problems."

This professor of psychology would sweep away two old, zealously maintained fallacies. One is that law-breakers in general may be set down as being of a low order personally and socially.

"Most of the great reformers of the past and (*Turn to next page*)

No Human Progress Without Crime—*Continued*

all the martyrs have been deliberate law-breakers," he pointed out. "Jesus was no exception, but rather the shining example. Such progress as Christianity has made has been due to those who refused to knuckle to the law merely because it was the law. Our greatest and most moral citizens in the United States—like our worst—are persistent law-breakers."

The other fallacy which Dr. Dunlap denounces is the theory that breaking an objectionable law leads to contempt for the more useful laws.

"This idea, that an individual develops a habit of committing crimes and becomes generally lawless would be important if true," he admitted. "But such knowledge as psychologists have on the subject of habit formation and the transfer of training is all against such simple assumption. Traffic laws are so universally broken that scarcely a motorist escapes arrest. But the man who gets a long traffic record for over-time parking, does not also pile up a record of arson, murder and swindling in the criminal courts. If law-breaking of any kind were an all-round school for crime, then the game laws would have been a university; for numerous citizens, otherwise respectable and responsible, have found the game laws a great game of law-breaking for years.

"Such law-breakers do not form a habit of committing crimes, because each individual's own circumstances are important factors that determine what laws he will break and what laws he will keep. These circumstances include his opinions of different specific laws, his understanding of the reasonableness of a given law, and his moral attitude toward his fellowmen. His attitude towards the law enforcement machinery and his opinion as to whether the laws are justly enforced is above all important in determining his attitude toward the keeping the law."

So, the psychologist returned to the first half of his paradox, the statement that America must try to repress crime:

"Officials who have charge of enforcing legal machinery have no right to set up their judgment as to the desirability of ignoring any law or enforcing it loosely. Their task is to see that the law is enforced, whatever the law may be, and the public should feel assured that the legal machinery will operate impartially, inevitably.

DR. KNIGHT DUNLAP, Johns Hopkins psychologist, says that a crimeless nation is a stagnant one

"If a law is only partially enforced, the public's respect for the machinery of law enforcement decreases. Because partial enforcement is common, instead of rare, our growing attitude toward the ineffectiveness of legal machinery is becoming a menace.

"If I transport liquor in my car because I do not happen to consider the Volstead Act sound, and if I am pinched, I have no reasonable complaint and should take my medicine like a sport. If a bootlegger flees to avoid capture and the pursuing policeman shoots him, the policeman has my entire support. Failure of a police force to do its sworn duty jeopardizes the foundations of our social order. The Christian martyrs were to be applauded; but so were the Roman soldiers who were ordered to deal with them."

The flood of serious crimes in the past two decades may be laid to the frustration of the law, with bribery and false sentimentality playing large parts, the psychologist went on to declare.

"I am under the impression that Chicago is suffering from the Loeb-Leopold trial more than from any other one thing," he stated. "For in that trial, which focused the attention of the public on local legal machinery, highly paid attorneys and well-fed psychiatrists enabled the plain intent of the law against murder to be defeated. And Chicago has had many less spectacular cases from which the criminal classes have learned that money can buy immunity. I should like to see some statistician study the course of crime in the United States in the past twenty years, and find the high points of the crime curve that are related to such failures of law enforcement.

"It may be that hanging is not a good preventive measure. But if we have the penalty prescribed for deliberate murder and enforce it on the poor man or on the man who admits he is sane, and do not enforce it against the wealthy or against the man who enters the plea of insanity, we are encouraging murder and the gangsters will not hesitate to shoot when in a tight pinch. We are encouraging murder copiously today. Yet the law against murder is not one to which there is a serious, conscientious objection on the part of any reasonable portion of our citizenry."

So this psychologist's verdict on the whole matter is that the only hope of our civilization is to maintain both sides of the paradox: "On the one hand, the right and duty of the citizen to break laws against which his conscience rebels—and to take his punishment without whimpering if caught. On the other hand, the necessity of a police power which will either enforce a law justly or else treat it wholly as a dead letter."

"Constructive lawlessness is the vital spirit in American culture," Dr. Dunlap concluded. "Destructive lawlessness, which also is rampant in this country, is due in large part to the sudden introduction of immigrants from the countries of Europe where civilization has crystallized more solidly and where there is comparatively little progressive change.

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A three-mile motor tunnel, through which four rows of cars can travel, is being constructed in England under the Mersey River.

Practically half of the area of the United States is arid, mountainous, or otherwise lacking characteristics of good agricultural land.

New Aurora Mystery Solved

Astronomy

A mystery as to why a certain green color appears in the light of the Aurora Borealis, or northern lights, was dispelled at the closing session of the Ottawa meeting of the American Astronomical Society. The astronomers' attention was turned from more distant celestial objects to an astronomical phenomenon that happens in the earth's own atmosphere when they heard a paper sent in by Dr. V. M. Slipher and L. A. Sommer, of the Lowell Observatory, in Flagstaff, Arizona.

In July, 1928, there was a brilliant display of the northern lights visible from Flagstaff. Dr. Slipher, and his associate, proceeded to analyze its illumination by passing its light through the prisms of a spectroscope, and obtaining a record of the spectrum on a photographic plate. This spectrum showed the usual bright lines that had previously been observed in the auroral spectrum. They included a green one with a wavelength of 5577. Light waves, like their big brothers, radio waves, are identified by their wave length. Only instead of using meters, the astronomer uses what he calls the "angstrom unit," about one 250 millionth of an inch.

The line at 5577 was shown a few years ago by Dr. J. C. McClennan, of the University of Toronto, to be caused by a transition taking place in atoms of oxygen high in the earth's atmosphere when excited by electrons from the sun. Near this line, however, there was another, at wave length 5206. Nobody had ever noticed this before, so it seemed that one mystery had been solved only to have a new one appear.

The two Arizona astronomers now report that atoms of nitrogen undergoing a transition from one state to another are the cause. In fact, light showing this line can be obtained experimentally in the laboratory by electrical discharges in mixtures of ordinary nitrogen and inert gases such as helium and neon.

They summarized their work as follows:

"The investigations up to the present time have shown that in the high atmosphere, where the aurora originates, nitrogen molecules, nitrogen molecule ions and oxygen atoms are present during an auroral display. The observation of the line 5206, and its interpretation as atomic nitrogen, indicates the presence of nitrogen atoms at the time of such a display."

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Astronomers Elect

Astronomy

At the election of officers, Dr. R. G. Aitken, who has charge of the Lick Observatory of the University of California, was elected vice-president of the American Astronomical Society. Dr. E. S. King, of the Harvard College Observatory, and Dr. F. H. Seares, assistant director of the Mt. Wilson Observatory at Pasadena, Calif., were made members of the society's council. Dr. S. A. Mitchell, of the University of Virginia, will represent the society in the National Research Council. Dr. R. S. Dugan, of Princeton University, the secretary, and Dr. Benjamin Boss, of the Dudley Observatory, at Albany, N. Y., treasurer, were reelected to their respective offices. It was decided to hold the next meeting at the end of December at the Harvard Observatory, in Cambridge, Mass.

Science News-Letter, September 14, 1929

About one-third of the United States receives too little rainfall for important crop production.

Checks Jupiter's Moons

Astronomy

Prof. E. W. Brown, of Yale University, president of the American Astronomical Society, told the members of his work on computing the orbit of the eighth moon of Jupiter. Several times this faint satellite has been lost by the astronomers, but Prof. Brown hopes that his work will permit them to predict its path with sufficient accuracy that they will always be able to find it. He is known as the world's greatest authority on the motion of our own moon. This is one of the most difficult of astronomical problems, because of the numerous ways that it is pulled to and fro by the gravitational attraction of all the other things in the solar system. The path of the eighth moon of Jupiter is much more elliptical than that of the moon, and this fact, with other of its peculiarities, makes it very hard to calculate its motion.

"It has all the difficulties of the lunar theory, all of the planetary theory, and then some!" he declared. But now he has completed the first stage of his work, and he hopes, when he has finished it, which he expects to do this fall, that the satellite will behave in a seemly manner, and move in the paths of rectitude to which it has been assigned.

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Describes Longest Eclipse

Astronomy

Hope that any astronomers might have had of some day seeing a total eclipse of the sun lasting nearly eight minutes were blasted when Mrs. Isabel Lewis, of the U. S. Naval Observatory, in Washington, reported on her investigations of how long an eclipse may really last. She was led to this investigation, she said, by finding that three different authorities gave three different values. One old figure, but still given, was 7 minutes and 58 seconds, another was 7 minutes and 40 seconds, while Simon Newcomb, a famous American astronomer, said that 7 minutes and 30 seconds was its maximum possible duration.

A total eclipse of the sun occurs when the moon's shadow touches the surface of the earth. The shadow is a cone, so it is largest where it hits the earth when the moon is nearest the earth and the sun farthest. This condition must exist, and the shadow must fall on the equator, so that the observer may travel fastest with the shadow, in order to have the longest possible eclipse, said Mrs. Lewis. Then the sun will be obscured for 7 minutes and 31 seconds, she discovered.

As the combination of sun farthest and moon nearest now occurs about two weeks after the beginning of summer, an eclipse of longest possible duration would have to occur about July fourth. But no astronomers need expect to celebrate American Independence Day with the longest eclipse, for many centuries will elapse before one occurs under the proper conditions. Owing to one of the notions of the solar system, the necessary conditions are changing for the worse. Five thousand years from now, said Mrs. Lewis, the moon will be nearest in September, and then an eclipse will only be able to last 7 minutes and 14 seconds.

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Calcium Clouds Spread Through Space

Astronomy

A vast cloud of calcium, one of the commonest of earthly elements, and familiar as a component of lime, permeates all the space between the stars in the Milky Way system to which our sun belongs. It shares the motion of the Milky Way system, or Galaxy, in slowly turning around a center, along with most of the other celestial objects that belong to our own swarm. This announcement was made by Dr. J. A. Pearce, of the Dominion Astrophysical Observatory at Victoria, B. C., speaking at the meeting of the American Astronomical Society at Ottawa.

Dr. Pearce and his chief, Dr. J. S. Plaskett, have been working on this problem for five years, he stated, and have now solved one of the chief problems that they presented.

Though so widely distributed, the calcium is exceedingly diffuse, it is far less dense than the highest terrestrial vacuum. Yet when the light from distant stars passes through it, it takes out certain colors, and when the light is examined through the prisms of an astronomical spectroscope, dark bands appear. Some bands and lines would appear in the spectra of the stars even if there were no calcium, but there is an important difference. As the stars move or recede from us, the lines in their spectrum are displaced to one end or the other. But the calcium bands, due to material that does not share in the individual motions of the stars, always appear in the same place, and so they can be identified. However, while the existence of the clouds has been recognized, astronomers have been divided as to how they are distributed.

"They surround the stars," said one group.

"No, they are spread through space," said the other, chiefly represented by the English astronomer, Prof. A. S. Eddington of Cambridge. Dr. Plaskett and Dr. Pearce have now proven that this view is correct.

Should there be any further doubts as to the reality of the gradual turning of the Galaxy, Dr. Pearce also presented the results of another research on which he and Dr. Plaskett have been engaged. This concerned a group of stars of the type known to astronomers as O and B. They measured their motion towards us or away from us, as shown by the displacements of their spectral lines, and found that these motions could only be explained by such a galactic rotation.

This rotation is such that the sun travels around, and the Solar System with it, at a speed of 180 miles a second. Yet so far is the trip around this celestial merry-go-round that it will take us 120 million years to complete a single circuit.

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Maker Tells of Large Telescopes

Astronomy

The available funds of the astronomer are the chief limit to the size of telescopes that cen be built.

So declared J. W. Fecker, of Pittsburgh, in a lecture in connection with the meeting of the American Astronomical Society at Ottawa. He is the successor to John A. Brashear, one of the most famous of telescope makers of the past. During his previous connection with a Cleveland firm, he designed the 72-inch telescope now at Victoria, B. C., second largest in the world. Now he is engaged in completing one only slightly smaller for Ohio Wesleyan University. In this instrument the light from the stars will be collected by a dish-shaped mirror 69 inches in diameter, so that it will be the third largest in the world. This mirror is being constructed from glass made at the Bureau of Standards, in Washington. It is the largest piece of optical glass ever prepared in the United States.

But the astronomers are constantly calling for bigger and better eyes with which to scan the heavens, and a combination of astronomical and engineering science can supply their wants, said the speaker. Telescopes with mirrors even larger than 200 inches, the size of one now being designed for the California Institute of Technology, can be built, he believes. Such instruments cost money, however, and the price of a telescope with a mirror several hundred inches in diameter would be many millions of dollars—nearly as much as a single battleship.

With the coming of these giant instruments there has been developed an entirely new method of design and construction. Years ago, a large telescope was mainly a one man job, so far as design was concerned. The size and relation of the various parts were determined by trial and error. Now, engineering has entered astronomy, said Mr. Fecker. The telescope maker must design the telescope with all the engineering skill used in planning and erecting a bridge. But the large telescope is comparable to a drawbridge that works with the precision of a fine watch. To achieve this the astronomer, the engineer and the optician must all cooperate, each contributing his special knowledge.

Many new materials are now available and must be used in the future, he said. These include such things as duralumin, alloy used in girders for airships, to make moving parts that must be as light and rigid as possible; or new kinds of glass or quartz for lenses and mirrors.

Another paper presented to the astronomers by Prof. R. K. Young, of the University of Toronto, indicated one improvement that may come in the future for reflecting telescopes. In the reflector, the concave mirror is ordinarily covered with silver to reflect the light to the focus. Though universally used, silver is not ideal. Even when new, it reflects red light better than blue, or the shorter invisible waves beyond, in the ultra-violet. It soon deteriorates, and does so most rapidly in this same blue and ultra-violet region. Yet these are the very waves in which the astronomer is most interested. Prof. Young made comparative tests of the reflecting power of silver and chromium, a metal formerly rather rare, but now common as one of the chief constituents of stainless steel, commonly used for kitchen knives. When new, he found, a chromium surface does not send back as much light as silver, but it does reflect all colors equally well, and reflects the ultra-violet as well as silver. Furthermore, it does not tarnish, and a coat a year old is as good as new, and much better than silver of the same age. So the same quality that has made chromium of value in peeling tomatoes may help the astronomer solve the secrets of the stars.

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New Time Method

Astronomy

A new method of telling time was described to the astronomers by Prof. F. B. Littell, from the Naval Observatory in Washington. The usual method of finding time from the stars, which is the ultimate source of our time no matter where we set our watches, is with the use of a transit. This is a telescope swinging around an east and west axis. Thus it can only move in the meridian, from north to south. The astronomer watches the star through it and as it reaches the center, the exact time indicated by the observatory clocks at the moment is recorded. As the position of the star is known with precision, the astronomer can tell when it should have crossed the center, so he knows the amount that his clock is fast or slow.

Prof. Littell's suggestion was to use another, and less common instrument, the "photographic zenith tube," for telling time. This is a special form of telescope that points directly overhead. Half-way down is a dish of quicksilver, or mercury. The surface of the mercury is always exactly level, and so the light that enters the tube is reflected back to the top. A tiny photographic plate just below the lens receives this light, and a record is left of the star. By letting the star trail across the plate, in a special holder that gets a jerk every second from a magnet connected to the clock, a series of short dashes are obtained. By measuring their position, said Prof. Littell, the time can be obtained more accurately than with a transit, because the mercury is always level, and so gives a point exactly overhead and precisely on the meridian.

Science News-Letter, September 14, 1929

In a recent survey of chronic sickness in Boston it was found that one-sixth of the chronic invalids were children.

Anemia is a comparatively new and serious disease among pigs, affecting especially those raised in the confined quarters of apartment style hog houses.

Transverse fissures in steel rails have been the cause of railroad wrecks, but the origin and reason for these defects still puzzle engineers and physicists.

A Free Biology Manual for High School Teachers

Our new catalog, which is now ready for mailing, is a combined teachers' manual and catalog of biological supplies for high school use. We have made every effort to make this 192-page book of real value to the high school teacher. It contains a Botany and Zoology Manual, a detailed article on the school aquarium, a large number of original illustrations and many short biological notes. The illustrations include over fifty original drawings, a large number of which are carefully labeled, diagrams of dissections and identification plates of laboratory plants and animals.

The Botany and Zoology Manuals, which occupy about sixty pages, are written especially for the high school teacher. In these manuals, we have made no attempt to present detailed courses of study, as such material is readily available in the many students' laboratory manuals now on the market. Instead, we have tried to include information which will be of value to the teachers in planning and carrying through a worth-while course in beginning biology. The desirability of studying living material is emphasized and we have made many suggestions as to ways in which teachers can collect and prepare much of their own laboratory material.

In the Zoology Section of the manual, the following type forms are discussed in detail, under such headings as collection, care of specimens in the laboratory, study of living specimens, etc.: Protozoa, Grantia, Hydra, Earthworm, Crayfish, Grasshopper, Honey-bee and Frog. The Botany Section of the teachers' manual considers in a similar way, Gleocapsa, Nostoc, Vaucheria, Spirogyra, Rhizopus (Mucor), Lichens, Mosses, Marchantia, Fern and Pine, as well as general discussions of the main groups—Algae, Fungi, Gymnosperms, Angiosperms, etc. An abundance of carefully labeled illustrative matter supplements the text.

Some of the practical suggestions will, we believe, be of value and interest to even the more experienced teachers. The following subjects are just a few of those which are discussed and explained in the manual:

Demonstrating how Hydra feed.
Finding living Vaucheria during the winter months.
Collecting mosses at the proper seasons.
Growing protozoan cultures.
Suitable material for a study of the angiosperms.
Studying living frog eggs.
Collecting insects.
Aquarium methods.
Living earthworms in the laboratory.
Regeneration experiments with Planaria.

The catalog section lists a very complete line of material for high school biology work. The items which have been included are those which are particularly useful in beginning biology courses. Many of the preparations have been specially developed to meet the need and requirements of high school teachers. In this section of the catalog are described—preserved and living specimens, microscope and lantern slides, demonstration preparations, life histories, models, charts, apparatus and instruments—everything, in fact, that is needed in the high school course.

This combined High School Biology Catalog and Teachers' Manual will prove of interest to every science teacher. We have already mailed copies to all teachers whose names are upon our mailing list. Addresses change, however, and if you have failed to receive your copy, please ask for it. One of these books will be sent to you at once and, we believe, that you will find it helpful and interesting.

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CLASSICS OF SCIENCE: Psychological Measurements of Individual Differences

Psychology

Dr. Cattell is one of the pioneers in breaking away from the introspective methods of the older psychology, and substituting quantitative measurements of mental processes. Here are the tests he was giving 40 years ago to all who would present themselves at his laboratory at the University of Pennsylvania.

MENTAL TESTS AND MEASUREMENTS. By Prof. J. McK. Cattell. In MIND, No. 59. London, 1890.

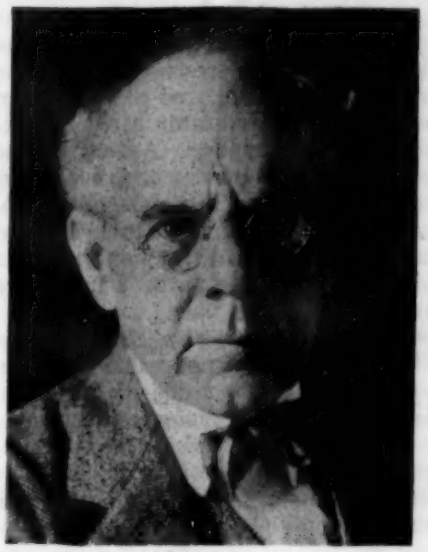
Psychology cannot attain the certainty and exactness of the physical sciences, unless it rests on a foundation of experiment and measurement. A step in this direction could be made by applying a series of mental tests and measurements to a large number of individuals. The results would be of considerable scientific value in discovering the constancy of mental processes, their interdependence, and their variation under different circumstances. Individuals, besides, would find their tests interesting and, perhaps, useful in regard to training, mode of life or indication of disease. The scientific and practical value of such tests would be much increased should a uniform system be adopted, so that determinations made at different times and places could be compared and combined. With a view to obtaining agreement among those interested, I venture to suggest the following series of tests and measurements, together with methods of making them.[1]

The first series of ten tests is made in the psychological laboratory of the University of Pennsylvania on all who present themselves, and the complete series on students of Experimental Psychology. The results will be published when sufficient data have been collected. Meanwhile, I should be glad to have the tests and the methods of making them thoroughly discussed.

The following ten tests are proposed:

I. Dynamometer Pressure.
II. Rate of Movement.
III. Sensation-areas.
IV. Pressure Causing Pain.
V. Least noticeable difference in Weight.
VI. Reaction-time for Sound.
VII. Time for naming Colours.

[1]Mr. Francis Galton, in his Anthropometric Laboratory at South Kensington Museum, already uses some of these tests, and I hope the series here suggested will meet with his approval. It is convenient to follow Mr. Galton in combining tests of body, such as weight, size, colour of eyes, etc., with psychophysical and mental determinations, but these latter alone are the subject of the present discussion. The name (or initials) of the experimentee should be recorded, the nationality (including that of the parents), and the age, sex, occupation and state of health.



DR. J. McKEEN CATTELL, President of the Ninth International Congress of Psychology, which met recently at Yale University

VIII. Bi-section of a 50-cm. line.
IX. Judgment of 10 seconds' time.
X. Number of Letters remembered on once Hearing.

It will be noticed that the series begins with determinations rather bodily than mental, and proceeds through psychophysical to more purely mental measurements.[2]

The tests may be readily made on inexperienced persons, the time required for the series being about an hour. The laboratory should be conveniently arranged and quiet, and no spectators should be present while the experiments are being made. The amount of instruction the experimentee should receive, and the number of trials he should be given, are matters which ought to be settled in order to secure uniformity of result. The amount of instruction depends on the experimenter and experimentee and cannot, therefore, be exactly defined. It can only be said that the experimentee must understand clearly what he has to do. A large and uniform number of trials would, of course, be the most satisfactory, the average, average variation, maximum and minimum being recorded. Time is, however, a matter of great importance if many persons are to be tested. The arrangement most economical of time would be to test thoroughly a small number of persons, and a large number in a more rough-and-ready fashion. The number of trials I allow in each test is given below, as also whether I consider the average or 'best' trial the most satisfactory for comparison.

Let us now consider the tests in order:

1. *Dynamometer Pressure.* The greatest possible squeeze of the hand may be thought by many to be a purely physiological quantity. It is, however, impossible to separate bodily from mental energy. The 'sense of effort' and the effects of volition on the body are among the questions most discussed in psychology and even in metaphysics. Interesting experiments may be made on the relation between volitional control or emotional excitement and dynamometer pressure. Other determinations of bodily power could be made (in the second series I have included the 'archer's pull' and pressure of the thumb and forefinger), but the squeeze of the hand seems the most convenient. It may be readily made, cannot prove injurious, is dependent on mental conditions, and allows comparison of right-and left-handed power. The experimentee should be shown how to hold the dynamometer in order to obtain the maximum pressure. I allow two trials with each hand (the order being right, left, right, left), and record the maximum pressure of each hand.

II. *Rate of Movement.* Such a determination seems to be of considerable interest, especially in connection with the preceding. Indeed, its physiological importance is such as to make it surprising that careful measurements have not hitherto been made. The rate of movement has the same psychological bearing as the force of movement. Notice, in addition to the subjects already mentioned, the connexion between force and rate of movement on the one hand and the 'four temperaments' on the other. I am now making experiments to determine the rate of different movements. As a general test, I suggest the quickest possible movement of the right hand and arm from rest through 50 cm. A piece of apparatus for this purpose can be obtained from Clay and Torbensen, (*Turn to next page*)

[2]Sharpness of sight (including color-vision) and hearing might, perhaps, be included in the list. I have omitted them because it requires considerable time to discover the amount and nature of the defect (which is usually bodily, not mental), and because abundant statistics have been published, and are being collected by oculists and aurists.

Psychological Measurements—*Continued*

Philadelphia. An electric current is closed by the first movement of the hand, and broken when the movement through 50 cm. has been completed. I measure the time the current has been closed with the Hipp chronoscope, but it may be done by any chronographic method. The Hipp chronoscope is to be obtained from Peyer & Favarger, Neuchâtel. It is a very convenient apparatus, but care must be taken in regulating and controlling it.

III. *Sensation-areas.* The distance on the skin by which two points must be separated in order that they may be felt as two is a constant, interesting both to the physiologist and psychologist. Its variation in different parts of the body (from 1 to 68 mm.) was an important discovery. What the individual variation may be, and what inferences may be drawn from it, cannot be foreseen; but anything which may throw light on the development of the idea of space deserves careful study. Only one part of the body can be tested in a series such as the present. I suggest the back of the closed right hand, between the tendons of the first and second fingers, and in a longitudinal direction. Compasses with rounded wooden or rubber tips should be used, and I suggest that the curvature have a radius of .5 mm. This experiment requires some care and skill on the part of the experimenter. The points must be touched simultaneously, and not too hard. The experimentee must turn away his head. In order to obtain exact results, a large number of experiments would be necessary, and all the tact of the experimenter will be required to determine, without undue expenditure of time, the distance at which the touches may just be distinguished.

IV. *Pressure causing Pain.* This, like the rate of movement, is a determination not hitherto much considered, and if other more important tests can be devised they might be substituted for these. But the point at which pressure causes pain may be an important constant, and in any case it would be valuable in the diagnosis of nervous diseases and in studying abnormal states of consciousness. The determination of any fixed point of quantity in pleasure or pain is a matter of great interest in theoretical and practical ethics, and I should be glad to include some such test in the present series. To determine the pressure causing pain, I use an instrument (to be obtained from Clay & Torbensen) which measures the pressure applied by a tip of hard rubber 5 mm. in radius. I am now determining the pressure causing pain in different parts of the body; for the present series I recommend the centre of the forehead. The pressure should be gradually increased, and the maximum read from the indicator after the experiment is complete. As a rule the point at which the experimentee says the pressure is painful should be recorded, but in some cases it may be necessary to record the point at which signs of pain are shown. I make two trials, and record both.

V. *Least noticeable difference in Weight.* The just noticeable sensation and the least noticeable difference in sensation are psychological constants of great interest. Indeed, the measurement of mental intensity is probably the most important question with which experimental psychology has at present to deal. The just noticeable sensation can only be determined with great pains, if at all; the point usually found being in reality the least noticeable difference for faint stimuli. This latter point is itself so difficult to determine that I have postponed it to the second series. The least noticeable difference in sensation for stimuli of a given intensity can be more readily determined, but it requires some time, and consequently not more than one sense and intensity can be tested in a preliminary series. I follow Mr. Galton in selecting 'sense of effort' or weight. I use small wooden boxes, the standard one weighing 100 gms. and the others 101, 102, up to 110 gms. The standard weight and another (beginning with 105 gms.) being given to the experimentee, he is asked which is the heavier. I allow him about 10 secs. for decision. I record the point at which he is usually right, being careful to note that he is always right with the next heavier weight.

VI. *Reaction-time for Sound.* The time elasping before a stimulus calls forth a movement should certainly be included in a series of psychophysical tests: the question to be decided is what stimulus should be chosen. I prefer sound; on it the reaction-time seems to be the shortest and most regular, and the apparatus is most easily arranged. I measure the time with a Hipp chronoscope, but various chronographic methods have been used. There is need of a simpler, cheaper and more portable apparatus for measuring short times. Mr. Galton uses an ingenious instrument, in which the time is measured by the motion of a falling rod, and electricity is dispensed with, but this method will not measure times longer than about one-third sec. In measuring the reaction-time, I suggest that three valid reactions be taken, and the minimum recorded. Later, the average and mean variation may be calculated..

VII. *Time for naming Colours.* A reaction is essentially reflex, and, I think, in addition to it, the time of some process more purely mental should be measured. Several such processes are included in the second series; for the present series I suggest the time needed to see and name a colour. This time may be readily measured for a single colour by means of suitable apparatus, but for general use sufficient accuracy may be attained by allowing the experimentee to name ten colours and taking the average. I paste coloured paper (red, yellow, green, and blue) 2 cm. square, 1 cm. apart, vertically on a strip of black pasteboard. This I suddenly uncover and start a chronoscope, which I stop when the ten colours have been named. I allow two trials (the order of colours being different in each) and record the average time per colour in the quickest trial.

VIII. *Bisection of a 50-cm. Line.* The accuracy with which space and time are judged may be readily tested, and with interesting results. I follow Mr. Galton in letting the experimentee divide an ebony rule (3 cm. wide) into two equal parts by means of a movable line, but I recommend 50 cm. in place of 1 ft., as with the latter the error is so small that it is difficult to measure, and the metric system seems preferable. The amount of error in mm. (the distance from the true middle) should be recorded, and whether it is to the right or left. One trial would seem to be sufficient.

IX. *Judgment of 10 sec. Time.* This determination is easily made. I strike on the table with the end of a pencil, and again after 10 seconds, and let the experimentee in turn strike when he judges an equal interval to have elapsed. I allow only one trial and record the time, from which the amount and direction of error can be seen.

X. *Number of Letters repeated on once Hearing.* Memory and attention may be tested by determining how many letters can be repeated on hearing once. I name distinctly and at the rate of two per second six letters, and if the experi- (*Turn to next page*)

Psychological Measurements—*Continued*

mentee can repeat these after me I go on to seven, then eight, etc.; if the six are not correctly repeated after three trials (with different letters), I give five, four, etc. The maximum number of letters which can be grasped and remembered is thus determined. Consonants only should be used in order to avoid syllables.

Experimental psychology is likely to take a place in the educational plan of our schools and universities. It teaches accurate observation and correct reasoning in the same way as the other natural sciences, and offers a supply of knowledge interesting and useful to everyone. I am at present preparing a laboratory manual which will include tests of the senses and measurements of mental time, intensity and extensity, but it seems worth while to give here a list of the tests which I look on as the more important in order that attention may be drawn to them, and co-operation secured in choosing the best series of tests and the most accurate and convenient methods. In the following series, fifty tests are given, but some of them include more than one determination.

Sight

1. Accommodation (short sight, oversight, and astigmatism).
2. Drawing Purkinje's figures and the blind-spot.
3. Acuteness of colour vision, including lowest red and highest violet visible.
4. Determination of the field of vision for form and colour.
5. Determination of what the experimentee considers a normal red, yellow, green, and blue.
6. Least perceptible light, and least amount of colour distinguished from grey.
7. Least noticeable difference in intensity, determined for stimuli of three degrees of brightness.
8. The time a colour must work on the retina in order to produce a sensation, the maximum sensation and a given degree of fatigue.
9. Nature and duration of after-images.
10. Measurement of amount of contrast.
11. Accuracy with which distance can be judged with one and with two eyes..
12. Test with stereoscope and for struggle of the two fields of vision.
13. Errors of perception, including bisection of line, drawing of square, etc.
14. Colour and arrangement of colours preferred. Shape of figure and of rectangle preferred.

Hearing

15. Least perceptible sound and least noticeable difference in intensity for sounds of three degrees of loudness.
16. Lowest and highest tone audible, least perceptible difference in pitch for C, C', C", and point where intervals and chords (in melody and harmony) are just noticed to be out of tune.
17. Judgment of absolute pitch and of the nature of intervals, chords and dischords.
18. Number and nature of the overtones which can be heard with and without resonators.
19. Accuracy with which direction and distance of sound can be judged.
20. Accuracy with which a rhythm can be followed and complexity of rhythm can be grasped.
21. Point at which loudness and shrillness of sound become painful. Point at which beats are the most disagreeable.
22. Sound of nature most agreeable. Musical tone, chord, instrument and composition preferred.

Taste and Smell

23. Least perceptible amount of cane-sugar, quinine, cooking salt and sulphuric acid, and determination of the parts of the mouth with which they are tasted.
24. Least perceptible amount of camphor and bromine.
25. Tastes and smells found to be peculiarly agreeable and disagreeable.

Touch and Temperature

26. Least noticeable pressure for different parts of the body.
27. Least noticeable difference in pressure, with weights of 10, 100 and 1,000 gms.
28. Measurement of sensation-areas in different parts of the body.
29. Accuracy with which the amount and direction of the motion of a point over the skin can be judged.
30. Least noticeable difference in temperature.
31. Mapping out of heat, cold and pressure spots of the skin.
32. The point at which pressure and heat and cold cause pain.

Sense of Effort and Movement[a]

33. Least noticeable difference in weight, in lifting weights of 10, 100 and 1,000 gms.
34. Force of squeeze of hands, pressure with thumb and forefinger and pull as archer.
35. Maximum and normal rate of movement..
36. Accuracy with which the force, extent and rate of active and passive movements can be judged.

Mental Time

37. The time stimuli must work on the ear and eye in order to call forth sensations.
38. The reaction-time for sound, light, pressure and electrical stimulation.
39. The perception-time for colours, objects, letters and words.
40. The time of naming colours, objects, letters and words.
41. The time it takes to remember and to come to a decision.
42. The time of mental association.
43. The effects of attention, practice and fatigue on mental time.

Mental Intensity

44. Results of different methods used for determining the least noticeable difference in sensation.
45. Mental intensity as a function of mental time.

Mental Extensity

46. Number of impressions which can be simultaneously perceived.
47. Number of successive impressions which can be correctly repeated, and number of times a larger number of successive impressions must be heard or seen in order that they may be correctly repeated.
48. The rate at which a simple sensation fades from memory.
49. Accuracy with which intervals of time can be remembered.
50. The correlation of mental time.. intensity and extensity.

[a] Organic sensations and sensations of motion, equilibrium and dizziness, should perhaps be included in this series.

James McKeen Cattell (1860-) studied under Wundt at Leipzig, taking his Ph.D. there in 1886. At that time he had already begun to experiment with measuring the minds of other people. At the University of Pennsylvania and at Columbia University he continued this objective method, which has become America's distinctive contribution to psychology. Dr. Cattell is editor of *Science, The Scientific Monthly, The American Naturalist,* and *School and Society,* and of *American Men of Science,* the biographical directory. He has been a trustee of Science Service since its founding in 1920, and is now its president.

Counting Fence Posts

Psychology

Do you count fence posts or houses on a block, as you walk along the streets? If so you have plenty of company, for this mental habit of counting is far more common than has been supposed, a Polish psychologist has found out.

Prof. Stefan Blachowski, of the University of Poznan in Poland, questioned several hundred students at the university and has found that 54 per cent of them have the inclination to count objects, to a greater or lesser degree. Reporting this investigation to the International Congress of Psychology, Professor Blachowski said that heretofore scientists have been attracted chiefly to the extreme and abnormal cases, such as individuals who feel themselves powerfully compelled to count the steps they take or the words they hear, and who become enslaved to a habit that they feel helpless to shake off.

Among the university students, counting was more prevalent among women than among men. About two-thirds of the women had the inclination, as compared with less than half of the men.

The objects the different students counted make a long list, Prof. Blachowski said. Among the most popular were planks in the floor, wall-paper patterns, windows, pictures, buttons, stops during a walk, trees, autos, books on shelves, equipages at funerals, stakes in fences, houses from one end of the street to the other, letters, money, and railway cars.

The statement made by one student applies to most of the cases, the psychologist said. This mental counter explained: "If I see something arranged in a row, pictures on the wall, for instance, I count them."

Another student said that when he took a railway journey he always counted the stations and the houses and jotted down his precise observations in a diary.

Since so many normal people occupy their minds with this form of thinking, Prof. Blachowski believes that the matter should be studied more deeply than when it was merely supposed to be a phase of mental disease.

Science News-Letter, September 14, 1929

"There is no greater handicap for any child than to have parents who refuse to allow him to grow up," according to Dr. Douglas A. Thom, specialist in child psychology.

Relativity Theory Reaches Psychology

Psychology

Body, soul, and mind are not three different substances, but only different degrees of one reality, according to Dr. Andrew Juhász, of Budapest, European psychologist attending the International Congress of Psychology at New Haven.

Speaking on the relations of body and soul, a mighty problem that puzzled the Greek philosophers and that has fascinated thinkers of every age, Dr. Juhász propounded a point of view that brings into psychology concepts of Einstein's relativity and concepts of the recent quantum theory in physics.

The mind should be considered as a medium between body and soul, between the material and the immaterial, the psychologist declared.

"The mind is a criterium of life and a bridge between the immortal soul and the lifeless mass," he stated. "The form in which the mind appears is the time, which must be relative, because the living mind shapes a moving system, and all our psychical experiences are related to this system. Life does not mean an objective space of time, it is only a period of the infinity. The possibility of the soul's realization, that is, the mind, has always slumbered in the body as the aboriginal energy of Einstein. The birth of the individuum is the actualization of the potency, and death is the transformation of his actuality into potency again.

"The realization is not a sudden action. It begins only with birth and lasts until death, until the potencies are exhausted. It is not a flowing procession, but it issues eruptively."

Dr. Juhász suggested that a psychological quantum theory should be evolved corresponding to the new concept in modern physics which conceives of light, electricity and other forms of energy moving in spurts or darts instead of a continuous stream.

Science News-Letter, September 14, 1929

No Pain Sensation

Psychology

When you cut your finger, you may be under the impression that you are experiencing a sensation of pain. But this is not the case, according to a French psychologist who specializes in the study of the human sensations.

There is no pain sensation, this professor, H. Pieron, of the College of France, told the International Congress of Psychology in New Hoven. Pain is really an emotional level which may be reached when certain specific sense organs are stimulated, he explained.

Science News-Letter, September 14, 1929

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Government Tests in Schools

Psychology

Uncle Sam is planning to put at the disposal of workers, employees and schools the Government's psychological tests and methods which during the past five years have revolutionized the Federal Civil Service employment methods, Dr. L. J. O'Rourke, Director of Personnel Research, U. S. Civil Service Commission at Washington, revealed to the International Congress of Psychology at Yale.

The establishment of national industrial standards for use in industry and aid to vocational guidance in schools and colleges is the purpose of this most ambitious attempt to make America psychologically conscious since the days of the World War when the army was classified by the then newly developed intelligence tests.

During the next year a committee of industrialists headed by H. S. Dennison of the Dennison Manufacturing Company will aid the Federal psychologists in trying out the tests on selected representative groups of workers in actual business life and manufacturing. This experience added to information in Government files as the result of examining sixty thousand federal job seekers each year will allow the psychologists to tell just what scores must be made by applicants or students to qualify for the usual tasks of everyday life.

Not for at least a year will the first tests be issued by the Government. Attention will first be given to office work such as typing, stenography, clerical work and bookkeeping that absorb the energy of thousands of America's young women. Then qualifications for other common vocations will be determined and made known to those who hope to fill them.

"We hope to make it possible for schools to tell their students six months before graduation how they compare in ability with the actual workers in the positions to which they aspire," Dr. O'Rourke explained. "For instance, a student would be told that she is better than eighty per cent. in stenography but only better than thirty per cent. in English. Then she would know that she must improve her English. It will be much better for students to know this before they finish school rather than discover it when they are job seekers."

If the tests show that an applicant or student is not fitted for a position to which he aspires or that his superior abilities would be wasted there, it is planned to advise him just what work his qualifications seem to indicate. It is also planned to make the lists of qualified applicants for federal jobs available for private firms needing new workers.

Vast savings in industry could be made if business and industry leaders would enlist the services of psychologists who, after learning the job techniques and the feelings of the workers, could simplify work, prevent accidents, keep interest in the work running high, and improve tools and working conditions, Dr. Walter V. Bingham of the Personnel Research Federation of New York City told the Congress.

Research into existing workers and their weaknesses is even more important than the proper hiring of new employees, he declared. How industry is beginning to appreciate what psychology can do for it is exemplified in a striking accident prevention effort directed by Dr. Bingham for the street railways of Boston. The past year during which psychologists personally studied motormen with many accidents on their records resulted in over a third less accidents. Worry over home life was one of the most frequent troubles of motormen with bad accident records.

Unhappily Dr. Bingham finds that there is a mere handful of psychologists, adequately trained and yet familiar with business and industrial worlds, who are capable of performing such service. A special sort of psychologist is necessary and he therefore urged that an institute of industrial psychology should be established in which graduate psychologists could be trained just as doctors are given finishing touches during their internships in hospitals. England, France, Germany and other countries have such institutes but America has been backward in this respect.

Science News-Letter, September 14, 1929.

Why the Maiden's Blush?

Psychology

The rosy blush that is supposed to spread across the maiden's cheeks is not caused by fear or anger. Just the opposite emotion of shame is the cause of her mounting color, Dr. J. T. MacCurdy of Cambridge University, England, informed the International Congress of Psychology.

The ruddy badge of embarrassment was much more often worn in the days before we became civilized, he declared, and even today among savage peoples blushing is common in connection with eating, sleeping and illness as well as the common situations that embarrass modern maids and men.

Because the blush is caused by a rush of blood to the cheeks some have thought that it is connected with extreme physical activity, but Dr. MacCurdy holds that immobility caused by a desire to hide is the true cause. And even more fundamentally blushing is a response to a dangerous situation and the attempt to avoid risk by concealment. For savages even eating and sleeping were dangerous performances much more safely pursued alone. They felt ashamed of their danger and therefore they blushed. Today shame of sex, even in the case of the modest virgin, lies at the root of most modern blushing.

Science News-Letter, September 14, 1929

Wood Acids Corrode Lead

Chemistry

The creosoted wood conduits in which lead-coated telephone cables are sometimes cased for protection may, under some circumstances, become a menace instead of a means of preservation, according to R. M. Burns and B. L. Clarke of the Bell Telephone Company. In a communication presented before the American Chemical Society, they told of discovering in the air contained in such conduits appreciable quantities of volatile acids capable of corroding the lead sheathing. They have devised a method of estimating the quantity of such acids present, and told of their findings on a number of different kinds of lumber.

Science News-Letter, September 14, 1929

Burn Aluminum Dust for Intense Flame

Chemistry

A flame so intense as to melt its way through any known solid substance is produced by a new type of blowpipe, employing finely powdered aluminum instead of the more familiar hydrogen or acetylene gases. The new invention was described by Dr. Frank M. Strong of Syracuse University, speaking before members of the American Chemical Society at Minneapolis last week.

Dr. Strong described his device as follows:

"A screw conveyer carries a slow stream of aluminum dust from the bottom of a hopper out through the open end of a brass pipe. The dust is here met by a swift cross-stream of oxygen, with which it forms a fine and uniform suspension. From this point the mixture is passed forward through a larger tube, which a little farther along is divided up into eight smaller tubes. The latter diverge from the central tube for a short distance, and are then curved back inward so as to come to a sharp focus. The aluminum-oxygen flame can be lighted at this focus point with a match or Bunsen burner."

Dr. Strong's blowpipe combines the principles of the familiar oxy-hydrogen or oxyacetylene blowpipes with that of thermite, a powder used for the generation of intense heat on a limited area, such as the ends of rails in welding. Thermite consists of aluminum powder mixed with another chemical which on heating yields free oxygen at a rapid rate. In the new blowpipe the oxygen is supplied directly in the form of a gas instead of being generated on the spot from a chemical.

Science News-Letter, September 14, 1929

Improves Fertilizer

Chemistry

Breaking up a low-grade fertilizer and pushing its essential elements more compactly into another combination, as one might unpack three loosely-filled trunks and cram their contents into a single tightly-filled one, is a feat that is occupying much attention on the part of industrial chemists nowadays. E. L. Larison and R. J. Caro of the Anaconda Copper Mining Company told how their concern is carrying on this process, in the interest of saving bulk and economizing on freight and truckage charges.

Among the most widely used classes of fertilizers are the phosphates. A peculiarity of phosphates is that they can exist in three forms —three degrees of chemical packing. The basic metal—calcium, usually—can carry either one, two or three units of phosphoric acid. Since the phosphoric acid is what the farmer especially wants on his field, the triple phosphate is the most desirable form, from the point of view of economy in handling. In nature, however, phosphate rock usually occurs in the single, or monophosphate form. The trick of the manufacture is to break off the phosphate portion of part of this rock, and tack two units of it on to a calcium atom already carrying one unit, thus converting the monophosphate into the more concentrated triphosphate.

Science News-Letter, September 14, 1929

Acids from Sawdust

Chemistry

Indications of a possible future use for the sawdust that now makes useless and troublesome mountains around sawmills were contained in a paper by Prof. W. H. Peterson, R. J. Allgeier and Prof. E. B. Fred of the University of Wisconsin. In a cooperative chemical-bacteriological research program, they have discovered how to make the powdery wood waste into acetic acid, the active principle of vinegar, and lactic acid, which is what makes sour milk sour. Both these acids have industrial uses that render their domestic significance an entirely secondary matter.

Three steps were involved in turning wood into acid. The first was turning it into sugar, which was done by the old familiar method of treating it with a strong chemical, such as sulphuric or hydrochloric acid. Then the pulp was further treated with a carbohydrate-converting enzyme, contained in malt sprouts. Finally, the process was completed by the addition of a microorganism that has the power to ferment both hexose and pentose sugars into acid.

From 80 to 90 per cent of the sugar present was fermented, the resulting mixture of acids consisting of ten parts of lactic to one of acetic. Wood sugar produced by the Bergius process in Germany fermented equally well and gave the same yield and ratio of products.

Science News-Letter, September 14, 1929

Ripening Gas Harmless

Chemistry

Ethylene, the gas now used extensively to bring stored fruits to a ripe color, to blanch celery, and for other purposes, appears to be harmless to animal life if there is not much of it in the atmosphere. Furthermore, it has no effect on most of the processes of digestion, and may even facilitate the digestion of starch.

These conclusions appear justified on the basis of a report made before the American Chemical Society by Dr. Arthur D. Hirschfelder and Elmer T. Ceder of the University of Minnesota. The two chemists stated that young rats given water saturated with ethylene did not have their growth checked by it, nor did other rats suffer slowing down of growth when they lived in an atmosphere containing a low concentration of the gas. An atmosphere containing one per cent of ethylene, however, did inhibit growth.

Pepsin, trypsin and lipase, digestive juices that act on proteins and fats, were neither helped nor harmed by being saturated with ethylene, but amylase, the principal digester of starch, had its action augmented by similar treatment. Ethylene alone did not convert starch into sugar, the chemists stated.

Science News-Letter, September 14, 1929

An airplane equipped with non-shatterable glass recently crashed 200 feet, and no glass was broken.

Twenty-three United States government bureaus are sending exhibits to the Ibero-American Exposition at Seville, Spain, this year.

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Nature Ramblings

Natural History

By Frank Thone

Sea-Eel

Seers of sea-serpents have become scarcer during the past couple of decades; whether this is due to the increase of knowledge or the decline of drink might be hard to determine. But though the snaky monsters that used to haunt the front pages of summertime news have been let off with no better than a Scotch verdict, there are some snaky things still left in the sea that are all too real.

There are, of course, a few real snakes that live in the sea. They are very poisonous, but fortunately they are also very far away—off the coast of India. But right here at home, and strung along the coastlines of much of the rest of the world, there are big sea-eels, commonly called morays, that have more than a snake's viciousness, even though they have none of a snake's venom.

Morays like to live among the rocks where the thick seaweed grows and the tide swirls twice a day. There is good picking there—incautious little fish, and the softer-shelled crustaceans, and once in a while an overturned mollusk. Abalone hunters on the southern California coast say they have to be on the lookout for these hungry eels all the time, lest when they pry loose one of their shellfish they lose it immediately under a swirl of darting heads and writhing bodies.

And their anxiety is not all for the fate of their prey, either. The moray has plenty of savageness and not much sense, and will lunge at anything that moves and try to wrench out a mouthful of flesh. Fortunately, morays do not frequent the sandy beaches used for bathing, but anyone venturing into moray-haunted rock-tumbles in a bathing suit stands a chance of being most viciously bitten.

Science News-Letter, September 14, 1929

First Glances at New Books

The Early Story of Mankind—Marion G. Clark and Wilbur Fisk Gordy—*Scribners* (88c.). A simple and attractive schoolbook on a subject that is gaining the attention of curriculum-makers. The story starts with famous Greek and Norse myths, which show how our forerunners explained the beginning of things. With this basis, it proceeds to the realities of the early world, the homes, stone tools, arts, and beliefs of primitive human beings, and thence to the old civilizations of Egypt, the Near East, Greece, and Rome. The suggestions at the end of the chapters, "Things you may like to do," and the self-testing games are cleverly devised.

Ethnology
Science News-Letter, September 14, 1929

Social Changes in 1928—William F. Ogburn, Editor—*University of Chicago Press* ($1). A current record of progress in many different fields of social life.

Sociology
Science News-Letter, September 14, 1929

Dacia—Vasile Parvan—*Cambridge Univ. Press* ($3). Deals with the early civilizations of the Carpathian and Danube lands of Europe, told as a result of fifteen years of excavation. The volume is compiled from a course of lectures given by Prof. Parvan at Cambridge.

Archæology
Science News-Letter, September 14, 1929

What Men Brought from Europe to America—Marion G. Clark and Wilbur Fisk Gordy—*Scribners* ($1). A child's story of mankind, which opens by tracing the development of wandering, barbaric tribes into the French, English, and Spanish nations which were to play the leading roles in American exploration and colonization. A series of chapters on the ways of life in the Middle Ages and the Renaissance follows, and with this preparation the young reader or student is ready to understand the main points of the book—what the Europeans brought to America and what they found here.

Ethnology
Science News-Letter, September 14, 1929

Strange Birds at the Zoo—Julia T. E. Stoddart—*Crowell* ($1.50). Monologues and conversations by birds in the zoo, written for younger children.

Ornithology
Science News-Letter, September 14, 1929

An Outline of Abnormal Psychology—Edited by Gardner Murphy—*Modern Library* (95c.). The reader who wonders how minds go astray and how they return to normal will find this little book of great interest. Though small, the volume contains more than three hundred pages and covers a surprising territory. The chapters are by well-known specialists in abnormal psychology and the subject matter includes various aspects of insanity, feeble-mindedness, personality twists, and the origin of abnormal trends in children.

Psychology
Science News-Letter, September 14, 1929

The Excavations at Dura-Europos—Edited by P. V. C. Baur and M. I. Rostovtzeff—*Yale Univ. Press* ($1). At this old fortress-town in North Africa, an expedition from Yale and from the French Academy of Inscriptions and Letters has been digging out towers, bastions, the city gate, statues, inscriptions, and small objects, all of which shed light on the history and culture of the Hellenistic-Roman period. The report deals with the first season of work, in the spring of 1928.

Archæology
Science News-Letter, September 14, 1929

The People of the Twilight—Diamond Jenness—*Macmillan* ($3). Two years among the primitive Eskimos of the Coronation Gulf region of Arctic Canada gave rise to the interesting experiences detailed in this book. The great Nansen pleads with the author that the Canadian people and authorities allow the Eskimos to live their own lives in such a way that the game may he preserved along with the economic balance which has arisen in those Arctic regions.

Ethnology—Exploration
Science News-Letter, September 14, 1929

Proceedings of the Eighth Annual Meeting of the Highway Research Board—Roy W. Crum—*National Research Council* ($2). Each year the scientists whose labors provide smooth and economical travel surface for automobiles and trucks meet in Washington under the auspices of the National Research Council to discuss the science of road-building. The proceedings of the last meeting are full of facts vital to highway engineers.

Highway Engineering
Science News-Letter, September 14, 1929

First Glances at New Books—*Continued*

GEOLOGY FROM ORIGINAL SOURCES—William M. Agar, Richard Foster Flint and Chester R. Longwell—*Holt* ($3.75). A collection of extracts from the writings of the great in geology, supplemented by contemporaneous accounts of volcanic outbursts, court decisions on boundary disputes, and other pertinent and interesting information for students of geology. The extracts are arranged by subject for easy reference. The materials and forms making up the crust of the earth are dealt with exclusively. It is to be hoped that the compilers will follow this volume with a companion on the paleontological side of the science.

Geology
Science News-Letter, September 14, 1929

EARTHQUAKES AND BUILDING CONSTRUCTION—*Clay Products Institute of California* ($2). Although prepared with special reference to brick and clay tile, this inquiry contains much valuable engineering material.

Civil Engineering
Science News-Letter, September 14, 1929

ARC WELDING, LINCOLN PRIZE PAPERS—Edward Pierce Hulse—*McGraw-Hill* ($5). Welding, the process of joining metals together which is finding increasing use in industry, has presented many new problems to engineers and metallurgists. The solution of some of them is contained in the essays that comprise this book compiled by the American Society of Mechanical Engineers.

Mechanical Engineering
Science News-Letter, September 14, 1929

SIMPLIFICATION OF HIGHWAY TRAFFIC—William Phelps Eno—*Eno Foundation* ($3.50). The theory and practice of regulating the thousands of automobiles that throng our streets is set forth in this study by one of the pioneer students of traffic.

Highway Engineering
Science News-Letter, September 14, 1929

INTRODUCTION TO TEXTILES—A. E. Lewis—*Pitman* ($1). A British book for students, describing chiefly cotton, wool and silk; their classification, origin, properties, treatment, and by-products.

Technology
Science News-Letter, September 14, 1929

THE CONTROL OF FLOODS BY RESERVOIRS—Paul Bailey—*Department of Public Works, California* (Free). A technical report of interest to hydraulic engineers.

Engineering
Science News-Letter, September 14, 1929

A CONCISE SUMMARY OF ELEMENTARY ORGANIC CHEMISTRY—Frederick Hurn Constable—*Dutton* ($2). This is what would be called in America a "quiz compend" since it gives in compact and consecutive form the facts about the preparation, properties and reactions of the main classes of organic compounds. It is designed to assist students in preparing for examination in English universities, but will be serviceable here for a similar purpose.

Chemistry
Science News-Letter, September 14, 1929

TEN OUTDOOR MEN—James Speed—*Heath* (72c.). Accounts written for boys, of Burroughs, Roosevelt, Burbank, Muir, Washington, Alexander, Wilson, Jefferson, Webster, Johnny Appleseed and Audubon—a strangely assorted yet very goodly company.

Biography
Science News-Letter, September 14, 1929

ANIMAL BIOLOGY—H. H. Lane—*Blakiston* ($3.50). A textbook for beginning students in college zoology. The author is deserving of commendation for including such topics as ecology, animal psychology and paleozoology, frequently omitted from courses of this kind.

Biology
Science News-Letter, September 14, 1929

GREAT BRITAIN—ESSAYS IN REGIONAL GEOGRAPHY—Edited by A. G. Ogilvie—*Cambridge University Press* ($7). Anyone contemplating a trip to Great Britain off the tourist beaten track would do well to use as a handbook this volume compiled by twenty-six British scientists on the occasion of the Twelfth International Geographical Congress.

Geography
Science News-Letter, September 14, 1929

THE USEFUL ART OF ECONOMICS—George Soule—*Macmillan* ($2). To bring together for the non-professional reader many of the present trends in economics is the purpose of this readably written book.

Economics
Science News-Letter, September 14, 1929

LINDBERGH, HIS STORY IN PICTURES—Francis Trevelyan Miller—*Putnam* ($2.50). Another record of America's aviation hero.

Aviation
Science News-Letter, September 14, 1929

AVIATION, ITS COMMERCIAL AND FINANCIAL ASPECTS—Richard Rea Bennett—*Ronald Press* ($3). Aviation is considered from the financial and commercial aspects, in which this book differs from most of the other aviation books.

Aviation—Economics
Science News-Letter, September 14, 1929

AVIGATION BY DEAD RECKONING—Ienar E. Elm—*McKay* ($2). A concise and practical book of instruction in the fundamentals of aerial navigation.

Aviation
Science News-Letter, September 14, 1929

DICTIONARY OF AERONAUTICAL TERMS—J. Vanier—*The American Society of Mechanical Engineers* ($1.65). This dictionary giving German-English-French equivalents for aeronautical terms should undoubtedly be slipped into the luggage bag of every ambitious aviator these days.

Aviation—Linguistics
Science News-Letter, September 14, 1929

AMERICA CHALLENGED—Lewis F. Carr—*Macmillan* ($3.50). An economic consideration of the farm problem which appeals to the author as "the greatest single source of conflict and instability in the history of this country."

Agricultural Economics
Science News-Letter, September 14, 1929

WIRING THE FARM—*Committee on the Relation of Electricity to Agriculture* (50c.). Now that the electrical web of the nation is extending into rural districts this book will undoubtedly aid many householders in bringing into their homes the advantages of electrical lighting, heat, and power.

Electricity
Science News-Letter, September 14, 1929

COMMERCE AND ECONOMIC RESOURCES OF OUR OUTLYING TERRITORIES AND POSSESSIONS—Foreign Commerce Department, U. S. Chamber of Commerce—*U. S. Chamber of Commerce* (20c.). A useful pamphlet of facts and figures on outlying America.

Economics
Science News-Letter, September 14, 1929

STAY-AT-HOME BIRDS—Mae Norton Morris—*Crowell* ($1.50). A child's book about birds that do not go south in the winter, and about some other birds that do.

Ornithology
Science News-Letter, September 14, 1929

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